the ease of implementation and reliability is similar to that of the previous groundwater alternatives.

This alternative is protective of the public health and welfare and the environment. It meets or exceeds the remedial objectives established for the Site. Because the alternative is designed to capture the entire plume it will effectively prevent, mitigate and eliminate any present or future threat to the public health, welfare and environment. Of the groundwater alternatives evaluated, this alternative, GW-4, meets all applicable or relevant and appropriate Federal public health and environmental requirements.

The use of GW-4 eliminates any potential impacts to the aquifer by using containment and disposal techniques. These techniques are acceptable and proven technologies for removing and treating contaminants from the groundwater. The alternative does not recycle,reuse or destroy the wastes, rather it eliminates the adverse impacts by stripping the VOCs from the groundwater and utilizing the assimilative capacity of the ambient atomsphere to prevent future environmental impacts. As a result, the benzene plume will ultimately be removed from potentially impacting the aquifer directly downgradient of the Site as well as the Wells G and H aquifer. The length of time required to completely remove all the contaminants of concern was not estimated in the FS. However the FS did estimate that it would take approximately ten years to complete one flush cycle in the contaminated portion of the aquifer. Data on transmissivity, storage coefficient and aquifer yield gathered as part of the RD will enable a better prediction as to length of time required to clean the aquifer.

This alternative, similar to GW-3, has several potentially adverse impacts. While the remedy effectively controls or eliminates the impacts to the aquifer resulting from the Site, neither alternative adequately addresses ongoing and potential problems around the Site. The increased capital and operation and maintenance costs, increased period of performance required to meet objectives and the potential of the need to handle a hazardous waste sludge make this alternative of questionable benefit as an remedy. In addition to the above noted concerns, the RI calculated that there was likely to be a localized lowering of the groundwater table as the result of the substantial pumping required for the interception/recovery network to be effective. This decrease in the localized water table may partially dewater portions of wetlands located south of the Site.

V. COMMUNITY RELATIONS

The Industri-plex 128 site was one of the first sites identified in Region I. In addition the Site was the highest scoring site

within the Region on the NPL while another site (Wells G&H) associated with childhood leukemia was located just south of this Site. As a result public and media attention as well as community involvement has always been very high.

In April 1980, the Massachusetts Secretary of Environmental Affairs formed a Citizens Advisory Committee (CAC) under a provision in the Massachusetts Environmental Policy Act (MEPA). The committee, consisting of representatives of the city, local residents, ad hoc environmental groups, the Chamber of Commerce and surrounding towns, has met on a regular basis to be briefed by regulatory personnel, comment and have input on draft proposals or reports. By all standards the involvement of the CAC has been an outstanding success in allowing the impacted community to be involved in the decision making process while allowing the regulatory agencies to have a better understanding of the needs and feelings of the community.

In addition to the CAC, the Agency has held numerous public meetings. Upon completion of the RI/FS the Agency held a formal Public Hearing on the RI/FS in July 1985. Comments received with Agency responses are appended in the Responsiveness Summary.

VI. CONSISTENCY WITH OTHER ENVIRONMENTAL REQUIREMENTS

The CERCLA Compliance with Other Environmental Statutes Policy requires that subject to limited exceptions, Superfund remedies shall attain or exceed applicable or relevant and appropriate Federal environmental and public health requirements in CERCLA response actions. This policy is embodied in 40 CFR §300.68(h)(iv) which requires as part of the detailed analysis of alternatives an evaluation of the extent to which the alternatives attain or exceed the applicable or relevant and appropriate requirements (ARARs). Where the FS was initiated but the remedy not selected as of the October 2, 1985 effective date of the policy, the ARARs analysis was to be incorporated into the FS and Record of Decision (ROD) as practicable.

A review of applicable or relevant and appropriate Federal public health and environmental requirements was conducted as part of the FS. This evaluation was deficient with respect to §300.68(i) of the NCP, dated November 20, 1985. As a result, the Agency undertook an independent review of the requirements to determine their possible implementation at the Site. Summarized below are the findings for each environmental media requiring remedial action.

As applied to this case there are three types of ARARs: cleanup levels of hazardous substances, cleanup technology requirements and requirements triggered by the implementation of cleanup activities.

Soils

With respect to soils contamination at the Site, there are not ARARs

establishing cleanup levels.

With respect to cleanup technologies, RCRA requirements were reviewed as potential ARARs. As the wastes were disposed of prior to the effective implementation date of the RCRA waste management regulations, RCRA was determined not to be applicable. If the wastes on-site were either a listed waste or met the characteristic waste tests, then all the waste management requirements of RCRA would be relevant and appropriate. The metal wastes found on-site are neither listed nor meet the characteristic tests. However certain technological engineering concepts were viewed to be relevant and appropriate. RCRA closure requirements call for impermeable covers for landfills. The rationale for this technology is that an impermeable cover eliminates the potential for direct contact and mitigates adverse groundwater impacts resulting from percolation of precipitation through the wastes. Results from the RI indicate that percolation of precipitation through the metal wastes at this Site is not presenting a significant impact to off-site groundwater. As a result the requirement of impermeability is not relevant and appropriate to capping technology at this Site. However, the use of a cap is appropriate to eliminate the potential for direct contact.

For alternatives that cap wastes in-situ or consolidate wastes elsewhere on-site, sections of Part 264 Subpart G involving closure and post closure care are also relevant and appropriate for use at this Site. Part 264 Subpart G requires a written closure plan for the Site, establishes a period of post-closure care (30 years) and use of the property and outlines maintenance and monitoring requirements. In addition, this Subpart outlines a procedure for documenting the location of the wastes to ensure against accidental disturbance. The primary purpose of this subpart is to ensure that the effectiveness of the remedial action is maintained and that, in the event of a problem it is quickly detected and resolved.

Implementation of several of the alternatives considered in the FS would trigger other ARARs. For instance; Alternatives that require discharge of fill material to a wetlands trigger CWA §404(b)(1) guidelines. In addition, Federal actions involving wetlands are subject to the conditions of Executive Order 11990. The essence of these two requirements is to prohibit the filling or impacting of a wetlands unless no other practicable alternative exists and to mandate mitigative measures where actions in wetlands are taken.

The implementation of the two requirements, noted above, involve areas of the Site where waste deposits are in direct contact with surface waters and wetlands. Specifically, these areas are the pond located between the East and West Hide Pile along with the stream discharging from the pond, the drainage ditch paralleling New Boston Street and the drainage swale next to the Chromium Lagoon area, draining into the Hall's Brook Storage Area. In each area, waste deposits are in direct contact with surface waters and wetlands. This situation exists as the result of either the

materials being placed into the wetlands during initial disposal or a drainage ditch being excavated through a waste deposit during Site development. In any event, the presence of these wastes in contact with the wetlands permits the continued release of contaminants to the environment. In order to eliminate this on-going release or threat of release, the waste material must be physically separated from direct contact with the surface waters and wetlands. Basically there are two methods for accomplishing this goal. The first involves excavating the material from the surface waters and wetlands and then placing the excavated materials in an uplands area. Excavation and removal of this material to an uplands would comply with §404(b)(1) of the CWA, as it only regulates the discharge of dredge or fill material into a wetlands, not the removal of the material. The second method involves the placement of either clean fill material or piping into the surface waters or wetlands to physically separate the wastes from the media. If the former alternative was available and practicable for use in a particular application, then this latter alternative would not comply with §404(b)(1) as it involves the placement of fill material into a wetlands. Neither alternative would comply with the intent of Executive Order 11990. This is because the Executive Order 11990 is much broader in scope than §404(b)(1). The Executive Order addresses any action (excavation or filling) which might adversely impact the wetlands.

The no action alternative, S-1, is the only remedial action which would not adversely disturb and impact the wetlands, thereby complying with §404(b)(1) and the Executive Order 11990. Under this alternative, the waste materials would be allowed to remain in, and adjacent to, the surface waters and wetlands. This would allow the continued release or threat of release to the environment. In addition, the alternative would leave exposed levels of toxic metals in excess of action levels determined to be protective of the public health and welfare. Due to the nature of the Site, there exists a real potential for individuals to come in direct contact with these exposed wastes. As a result of the continued release or threat of release to the public health and welfare and the environment the Agency rejected the no action alternative as not being protective and not meeting the established goals for the Site. As a result of this determination, the Agency has determined that there is no practicable alternative that exists which would comply with the Executive Order 11990 and not impact the wetlands. The Agency believes, however, that there remain alternatives that can be structured in such a manner as to minimize potential harm to the wetlands using mitigative measures and to compensate for any impact as required under §404(b)(1). For metal wastes, the deposits can be dredged from the wetlands, thereby complying with §404(b)(1) requirements; however, for the West Hide Pile this dredge alternative is not practicable because of the potential for release of obnoxious odors. As a result, in order to stabilize the side slopes of the West Hide Pile, some limited excavation and filling of the wetlands

will be required. The exact quantities are currently not known, however the projected areas of concern are detailed in the appropriate section and compliance with the technical requirements of §404(b)(1) will be incorporated into the Remedial Design process.

The National Ambient Air Quality Standards (NAAQS) of the Clean Air Act (CWA) may be applicable to alternatives involving the removal or placement of materials, either clean or waste deposits. The Standards, listed below, are mandatory goals for non-attainment areas to protect both the public health (primary standards) and welfare (secondary standards). The Total Suspended Particulates and Lead standards would be applicable during the excavation of waste material or the placement of cover material at the Site.

Applicable National Air Quality Standards

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Total Suspended Particulates	Annual	75 ug/m^3	----
	24 Hours	260 ug/m^3	150 ug/m^3
Lead	Quarterly	1.5 ug/m^3	same

During test pit excavation the RI collected and analyzed ambient air samples for these parameters to determine if a violation of the NAAQS standards existed. Results indicate that all remedial alternatives would be well below the standards.

In addition to the NAAQS requirements, the Unit Risk values developed by EPA's Carcinogenic Assessment Group were considered for use at the Site as a relevant and appropriate guideline under the CAA. Although referred to, at several points within the document, as an ARAR, the Unit Risk values fall within the category of standards that are "to be considered by the Agency". The definition of Unit Risk is the increased lifetime cancer risk occurring in a hypothetical population in which all individuals are exposed continously from birth throughout their lifetimes to a concentration of one ug/m^3 of the agent in the air they breathe. A lifetime is considered to be 70 years. These are considered guidelines and not requirements. Application at this Site could potentially apply during excavation and removal.

Chemical	Unit Risk
Benzene	8.0×10^{-6}
Chromium	1.2×10^{-2}

Chemical	Unit Risk
Nickel	3.0×10^{-4}
Toluene	NA

Results from the RI indicate that air emissions from implementation of any of the soils alternatives would be well below the established guidelines for the Unit Risk.

In addition to the relevant and appropriate requirements for the protection of the wetlands, National Ambient Water Quality Criteria may be relevant and appropriate for alternatives which involve the release or potential for release of contaminants to the surface water. Under the Clean Water Act (CWA) the Massachusetts Water Quality Standards are federally enforceable standards and would be applicable. In the absence of a numeric standard for a given substance in the State Water Quality Standards, the criterion is, under CERCLA policy, deemed relevant and therefore to be considered in the selection of the remedy. Listed below are the National Ambient Water Quality Criteria.

Compound	Concentration (ppm)[1]	Chronic 4 day avg/3 yr (ug/l)	Acute 1 hr avg/3 yr (ug/l)
Arsenic	<10 min	---	---
	288 avg	190	360
	30,800 max	---	---
Lead	ND min	---	---
	1,263 avg	1.3	34
	54,400 max	---	---
Chromium	<10 min	---	---
	718 avg	120 (11)[2]	980 (16)[2]
	80,600 max	---	---
Zinc	---	47	159
Copper	---	6.5	9.2
Mercury	---	0.012	2.4
Benzene	---	---	5,300
Toluene	---	---	17,500
di(ethyhexyl) phthalate	---	3	940
Phenol	---	2,560	10,200

1. Criteria variable; toxicity is dependent on hardness
2. Values within ( ) are for hexavalent chromium, other values are for trivalent.

These criteria are used to ensure that the surrounding water quality is not adversely impacted during or after the implementation of the remedial action. Efforts to minimize any potential threat of release or impact to the surrounding water quality would be incorporated as part of the Remedial Design process. For example, use of sedimentation basins and erosion control fabric are two possible techniques to prevent a surface water quality impact from occurring.

As stated previously, with the exception of the no action alternative, S-1, no alternatives will meet all the applicable or relevant and appropriate Federal public health and environmental requirements. Alternatives S-2, S-3, S-4, S-5, S-6, S-7, S-8, S-9, S-11, S-12 and S-13 would closely approach the level of protection provided by the applicable or relevant and appropriate Federal public health and environmental requirements.

Alternative S-11, the recommended remedial action, would comply with the applicable or relevant and appropriate Federal public health and environmental requirements. Because no practicable alternative exists which does not impact the wetlands, compliance with the mitigative measures required under §404(b)(1) will be required during the implementation of this alternative.

Unlike some alternatives which include consolidation or removal as part of the remediation, Alternative S-11 seeks to meet the wetland requirements by leaving the majority of the waste deposits in-situ. This would minimize the effects of sedimentation, erosion and the need to construct access and egress roads in and around the wetlands. Under the consolidation/removal alternatives the majority of the wetlands and surface waters would either be destroyed or altered during the implementation of the alternative. Under alternative S-11 waste deposits from the area south of the East and West Hide Piles which were in direct contact with surface water and/or wetlands would carefully be excavated, using a dragline. Sufficient quantity of material would be removed in order to allow limited placement of clean fill material to form a dike or berm between the surface waters or wetlands and the remaining waste deposits. The amount of waste material excavated would be in excess of the amount of clean fill material placed yielding a net positive increase in flood storage capacity and increasing the area for the affected wetlands to reestablish itself. The excavated material would be located in an upland area, eliminating any future impacts. In addition, the Agency shall also act to restore and preserve the natural and beneficial values of the wetlands.

Air

With respect to air contamination there are three ARARs establishing cleanup levels at the Site. First, as noted under the soils ARARs section, they are the NAAQS requirements. These standards would be applicable for use at this Site to ensure that the ambient air quality is not degraded as a result of air emissions from an air

treatment system. Listed below are the appropriate standards.

Applicable National Air Quality Standards

Pollutant	Averaging Time	Primary Standard	Secondary Standard
Sulfur Dioxide	Annual	80 ug/m^3	----
	24 Hours	365 ug/m^3	----
	3 Hours	----	1300 ug/m^3
Total Suspended Particulates	Annual	75 ug/m^3	----
	24 Hours	260 ug/m^3	150 ug/m^3
Carbon Monoxide	8 Hours	10 ug/m^3	same
	1 Hour	40 ug/m^3	same
Ozone	1 Hour	235 ug/m^3	same
Nitrogen Dioxide	Annual	100 ug/m^3	same
Lead	Quarterly	1.5 ug/m^3	same

The implementation of an ambient monitoring plan will be required to determine that the ambient air quality of the surrounding area is not degraded as a result of the implementation of an air alternative.

Second, because the potential exists that some carcinogenic volatile organic compounds may be emitted in low levels from the East Hide Pile the use of the Unit Risk values is relevant and appropriate for the Site. These values are summarized below.

Chemical	Unit Risk
Benzene	8.0×10^{-6}
Chromium	1.2×10^{-2}
Dioxin	3.3×10^{-5}
Nickel	3.0×10^{-4}
Phenol	NA
Toluene	NA

The third ARAR to be considered as relevant and appropriate is the applicable state requirement relative to the control of nuisance odors. Similar to the use of Unit Risk values in the previous section, use of State standards also falls into the

"to be considered" category and technically is not an ARAR. The Agency has decided, in accordance with parts 300.68(i)(4) and (i)(5)(ii) of the NCP, that the Commonwealth's "Regulations for the Control of Air Pollution" (310 CMR 7.00) to the mandates of the CAA and Massachusetts General Laws Chapter III, Parts 142 B and D, are relevant and appropriate to the East Hide Pile. There are no numeric standards for the control of odor, only the requirement that nuisance odors are not permitted to exist, and that every reasonable appropriate control technology be used to prevent the release of nuisance odors. While the Agency can regulate these odors based on their adverse impacts on the public welfare as defined in both CERCLA and CAA, the Agency considers 310 CMR 7.00, and specifically 310 CMR 7.09 relevant and appropriate since it formed the legal basis for the protracted litigation initiated by the DEQE and the Town of Reading against the Site's developer. This litigation resulted in an order issued by the presiding judge prohibiting any excavation at Industri-plex that could result in the release of odors. The judge prohibited excavation rather than requiring odor control measures during excavation because after experiments and field tests of various methods, none were found to be effective in preventing or minimizing the release of intense odors during excavation. The odor problem caused by the Site is so long standing and the community opposition to it is so strong that in addition to harming the public welfare, the intense, obnoxious odors that would necessarily attend excavating the pile would in all likelihood provoke renewal of the previously mentioned lawsuits.

It should also be noted that the Agency, the DEQE and Stauffer Chemical Company have agreed in their administrative consent order to treat odors as hazardous substances pursuant directly to the requirements of CERCLA.

With respect to ARARs triggered as a result of the implementation of a cleanup activity, §404(b)(1) and the Executive Order 11990 on Wetlands would be applicable. This is because a significant portion of the East Hide Pile is physically located in a wetlands. The implementation and restrictions for the air alternatives would be similar to requirements under the soils ARARs. As previously noted, these wetlands requirements prohibit impacting a wetlands unless no other practicable alternative exists.

The East Hide Pile is unstable and continues to slough material into the wetland and/or surface water and because it is essentially barren of vegetation allowing toxic material and material high in biological oxygen demand (BOD) to readily erode into the wetland and/or surface water every time it rains or snows. Any action taken to abate the continued sloughing of the pile into the wetlands would, by its very nature, impact the wetlands. For reasons previously stated in the soils section, there exists no practicable alternative which would not impact the wetlands. As noted above, any disturbance of the hide material releases a strong obnoxious odor. As a result, the technique of utilizing a dragline to excavate

the wastes from the wetlands is not appropriate. Because the side slopes of the pile are steep, thereby allowing continual sloughing, remedial actions to stablize the slopes are required. This will necessitate impinging on the wetlands. The FS illustrated remedial alternatives which involved the total draining and filling of the wetlands in order to eliminate the potential for direct contact and to lower the local groundwater table, thereby assisting in dewatering the pile. The Agency disagrees with the conclusion that it is necessary to dewater the wetlands in order to reach the remedial objectives established for the Site. The Agency believes that techniques involving sheet piling and more aggressive slope stablization methods can significantly minimize the impacts to the wetlands. The recommended remedial action for the air alternative uses the modified slope stabilization techniques to address this issue.

Groundwater

The groundwater protection requirements under 40 CFR Part 264 Subpart F would be relevant and appropriate to the groundwater problems associated with this Site. Subpart F requires that hazardous constituents in groundwater leaving the Site must not exceed the background level of that constituent in the groundwater, a Maximum Contaminant Level (MCL) or an Alternate Concentration Limit (ACL), site specific levels that are determined to be protective of the public health and environment.

Forty CFR Part 141 and Part 142 of the National Primary Drinking Water Regulations are regulations which implement the Safe Drinking Water Act (SDWA). The SDWA has promulgated interim Maximum Contaminant Levels (MCLs) for a number of metals and also has proposed MCLs and/or Recommended Maximum Contaminant Levels (RMCLs) for some metals and synthetic organic chemicals. Listed below are the RMCLs and MCLs for the compounds of concern:

Compound	RMCL(mg/l)	MCL(mg/l)
Arsenic	0.05 proposed	0.05 interim prom
Chromium	0.12 proposed	0.05 " "
Lead	0.02 proposed	0.05 " "
Benzene	Zero promulgated	0.005 proposed
Toluene	2.0 proposed	---

MCL's are standards for public water systems based on health, technological and economic feasibility. RMCL's are suggested levels for drinking water based entirely on health considerations. The use of MCLs and RMCLs as target groundwater cleanup levels is consistent with the RCRA requirements. Results from the groundwater sampling indicate groundwater leaving the Site is in excess of the established MCLs and RMCLs.

In addition to the applicable regulation, the Agency's Ground Water Protection Strategy (GWPS) establishes guidelines for protection of the nation's groundwater.

The strategy classifies all groundwater into three basic categories. The groundwater underlying the Site would be classified as a Class 2B aquifer. The Class 2B is an aquifer which is a Potential Source of Drinking Water and Water Having Other Beneficial Uses. As noted previously, the aquifer underlying the Site flows southerly feeding the portion of the Aberjona River aquifer which supplied Wells G and H, two of the City of Woburn's municipal drinking water wells. As noted above, the GWPS establishes guidelines for groundwater protection. For a Class 2B aquifer, cleanup of contamination will usually be to background levels or drinking water standards, but alternative procedures may be applied for potential sources of drinking water or water used for agricultural or industrial purposes. EPA recognizes that in some cases alternatives to groundwater cleanup and restoration may be appropriate. In addition the GWPS indicates that for groundwaters not used as current sources of drinking water, the Agency will also consider regulatory changes to allow variances in cleanup that take into account such factors as the probability of eventual use as drinking water and the availability of cost-effective methods to ensure acceptable water quality at the point of use. Other factors such as yield, accessibility, and alternative sources will also be considered.

Once the groundwater has been successfully extracted from the aquifer it would receive treatment to remove the contaminants prior to discharge. The effluent from the treatment system would need to comply with all applicable or relevant and appropriate Federal public health and environmental requirements. Two regulations are applicable to the treatment and discharge of the groundwater to a surface water. Section 303 of the Clean Water Act (CWA) requires that any discharge to a surface water be subjected to the federally enforceable Massachusetts Water Quality Standards. In the absence of a numeric standard for a given substance in the Water Quality Standards, the National Ambient Water Quality Criteria are applied. In addition §402(a)(1) - 402(a)(3) of CWA which deals with the National Pollutant Discharge Elimination System (NPDES) would be relevant and appropriate for the effluent of the treatment system. The NPDES program establishes limits on a permit by permit basis, using secondary treatment standards as a starting point. The permit program not only requires that mimimal treatment standards be met but that water quality standards (noted above) be attained as well.

As noted in the air section, the emission from the air stripping tower would be subject to the Clean Air Act, both in terms of the NAAQS standards and the Unit Risk guidelines.

Only alternative GW-4 would meet the applicable or relevant and appropriate Federal public health and environmental requirements.

By capturing the leading edge of the plume this alternative would ultimately reduce the levels in the groundwater to Drinking Water Standards. The FS estimates that this alternative would require in excess of ten years to accomplish this goal. Alternatives GW-3, GW-2 and GW-1 would not comply with the applicable requirements as each would allow levels to remain in the groundwater in excess of the RCRA requirements. The treatment systems outlined in GW-2, GW-3 and GW-4 are all capable of meeting NPDES and water quality standards. However, pilot studies during the Remedial Design would be necessary to ensure the effectiveness of the treatment system to remove metals to the low levels needed.

VII. RECOMMENDED ALTERNATIVES

Consistent with 40 C.F.R. §300.68(i), the following alternatives have been determined to be the cost-effective remedial alternatives that effectively mitigate and minimize threats to and provide adequate protection of public health and welfare and the environment.

This section summarizes the recommended remedial actions to be taken to eliminate the hazardous waste impacts to the contaminated soils, the East Hide Pile and the contaminated groundwater.

RECOMMENDED REMEDIAL ACTION FOR CONTAMINATED SOILS

Alternative S-11 was selected as the recommended remedial alternative under §300.68(i) of the NCP. The alternative will eliminate the potential for direct contact with contaminated soils at levels above 300 ppm arsenic, 600 ppm lead, and 1000 ppm chromium. These levels were established in the Endangerment Assessment (EA) as being protective of the public health and welfare and the environment. Specifically, the alternative will cap contaminated soils with clean materials to a depth sufficient to minimize the effects of the freeze-thaw cycle and the potential for exposure resulting from erosion. Based on knowledge and experience gained in other CERCLA responses, most notably the capping of asbestos landfills, the Agency has determined that thirty inches of clean cover material over an exposed deposit is an appropriate method for eliminating the potential for direct contact and future exposure. As a result the recommended remedial action will cover the exposed deposits with thirty inches of clean fill material. In areas where the waste is already partially protected by clean fill material, only enough additional cover material will be placed to provide for the minimum of thirty inches of protection. Areas containing buildings, roadways and parking lots would not receive cover material, instead allowing the structures themselves to act as the protective cap. In addition, there may be small areas on-site where it is more advantageous to remove waste material than to attempt to establish protection using cover material. These areas are likely to be around existing structures, i.e. the grassed area between a building and a parking lot. Clearly placement of an additional thirty inches of cover material

against an existing structure may be inappropriate and could result in significant problems. In these instances the waste material may be excavated from the area to an appropriate depth and the excavation backfilled with clean material. The excavated material will be consolidated elsewhere on-site with wastes having the same characteristics as the excavated material. Another alternative would be the placement of a protective layer such as asphalt to cap the deposit. In any event, these areas will be further identified and specific actions to resolve the issue will be developed during the Remedial Design process.

For areas where waste deposits are in direct contact with wetlands or surface waters, one of two alternatives will be used to eliminate the adverse impacts resulting from the potential for direct contact. First, for areas involving wetlands or the pond where there are no hide materials,the wastes will be excavated using a dragline. Use of a dragline will minimize the adverse impacts to the wetlands while allowing the wastes to be physically removed from the water. For areas containing hide materials which have the potential for odor release, the deposits will be covered in-situ, minimizing to the extent practical the impact on the wetlands. For manmade drainage swales, culverting may also be an acceptable alternative to the dragline.

Irrespective of the depth below grade, location or the presence of an existing structure, any areas containing wastes above the action levels will receive institutional controls. These controls are designed to ensure the long term effectiveness of the remedial action by preventing the unauthorized or inadvertent disturbance of the waste deposits. The nature and scope of the institutional controls will be similar to those required under Part 264 Subpart G of RCRA. Specifically, §264.117 Post Closure care and use of Property, §264.119 Notice to local land Authority and §264.120 Notice in deed to Property. In addition to these requirements, the Agency is currently investigating the possible modification of the City of Woburn's zoning regulations to further assist in the control and future use of the affected properties. The Agency recognizes that the remedial action may need to be disturbed or modified at some future point, given the amount of Site development currently existing. A plan outlining the conditions under which the remedial action could be disturbed will be developed and approved as part of the Remedial Design process.

The primary advantage of this alternative over previous alternatives, specifically S-4 is the lower capital and O&M costs resulting from the decreased area requiring remedial action. In S-4 the alternative encompassed any deposit above 100 ppm irrespective of depth below grade. In alternative S-11 clean uncontaminated fill material will be placed in sufficent quantity to establish a thirty inch protective layer. This effectively reduces the area from seventy acres under S-4 to

forty three acres under S-11. The alternative would control the difference in acreage by implementing institutional controls over those areas not receiving cover material. The approach used in S-11 is a sound and logical method for eliminating the potential for direct contact. First, the alternative uses values determined to be protective of the public health, welfare and environment, not an arbitrarily selected number. Secondly, the alternative minimizes unnecessary disruption to surrounding areas by covering only those areas necessary to minimize the effects of the freeze-thaw cycle and erosion. Finally, the use of institutional controls over the entire contaminated area will ensure the long term effectiveness of the remedial action.

This alternative is not without its disadvantages. The primary one involves the dependence on the use of institutional controls not only to ensure the long term effectiveness of the alternative, but as part of the alternative as well. An argument could be raised that the reliance on institutional controls is inappropriate as an effective means to contain the waste deposits on-site. The Agency recognizes that use of institutional controls have some disadvantages but that Site conditions are such that the use of them is the key to implementing an effective environmental solution to the Site. Because Site development occurred after the deposition of the wastes, many of the existing structures are built on top of waste deposits above the action levels. While it is unlikely that these deposits will be exposed to the public health or environment in the near future, at some point in time these deposits could pose a significant threat to the public health and environment as a result of the structure being removed or altered in some fashion. In order to prevent this from arbitrarily occurring one of two things must happen. Either the disturbance of the waste is controlled through institutional controls or the material must be physically removed from its present location and placed where the Agency can be assured it is not inadvertently disturbed. Removal from its present location is not justified, based on results in the EA, therefore in-situ covering and monitoring are the most appropriate remedial action to be taken.

In the event that institutional controls are not obtainable, this alternative would have to be reconsidered, leaving alternatives S-7, S-8, S-9 and S-13 as the more viable alternatives. Selection of one of these alternatives instead of S-11 would require a subsequent decision by the Regional Administrator.

Alternative S-11 was determined to be the most cost effective soils remediation alternative for the Site. As stated earlier, the alternative effectively prevents and minimizes the threats to, and provides adequate protection of the public health and welfare and the environment. While four alternatives (S-1, S-6, S-10 and S12) had lower costs than S-11, the degree of reliability was substantially less for each of them than the recommended remedial action. S-11 is the lowest cost alternative which eliminated the potential for direct contact and effectively minimized the effects of the freeze-thaw cycle and potential

for exposure resulting from erosion. Alternatives higher in costs than S-11 involved establishing an impermeable cap or consolidation of the wastes. While these features are desirable they are considerably more expensive and are not necessary to protect the public health and welfare and the environment at this Site. Summarized below are the alternatives evaluated and the reasons why they were not selected as the recommended remedial action.

Evaluation of the alternatives reveals that they can be broken into four categories.

No or Minimal response

S-1, No Action Alternative	$848,000
S-10, Limited excavation, fencing, Deed restrictions	$3,593,000

Permeable Covers

S-4, 24" Fill, 6" Topsoil, Vegetate, Deed Restrictions	$9,453,000
S-6, Limited excavation, 6" Topsoil, Vegetate	$5,323,000
S-11, 24" Fill, 6" Topsoil, Vegetate, Higher Action Level	$6,543,000
S-12, 6" Topsoil, Vegetate, Higher Action Levels	$4,253,000

Impermeable Covers

S-2, 24" Clay, 6" Topsoil, Vegetate, Deed Restrictions	$23,923,000
S-3, 6" Clay, 18 Fill, 6" Topsoil, Vegetate, Deed Restrictions	$13,575,000
S-5, 20 Mil Synthetic Membrane, 12" sand, 12" Fill 6" Topsoil	$12,703,000

Consolidation Actions

S-9, Consolidate On-Site, Cap Deposits with 20Mil Synthetic Liner No Backfill	$10,253,000
S-8, Consolidate On-Site, Cap Deposits with 20Mil Liner	$19,213,000
S-7, RCRA On-Site Landfill	$80,253,000
S-13, Removal & Off-Site Disposal	$209,680,000

Alternative S-1, the no action alternative, and S-10 limited excavation, fencing and deed restriction alternative, were rejected as inappropriate remedies for the Site. Both these alternatives were found not to meet the remedial objectives for the Site, nor would either meet or exceed applicable or relevant and appropriate Federal requirements. The RI determined that a substantial amount of waste deposits above the recommended levels were exposed or near surface. As a result, a direct contact potential existed. The S-1 Alternative clearly would do little to minimize or eliminate this potential. The S-10 Alternative, while taking positive steps to mitigate the short term direct contact potential by installing a fence around the exposed deposits would not provide for an effective long term means of preventing access to the Site and the exposed deposits.

In the five years since the initial installation of the fence, the Agency has made repeated attempts to repair damage to the fence resulting from vandalism. In the interim, unauthorized access to the Site continues. Implementation of either alternative would permit the continued release or threat of release of hazardous substances to the environment from the waste deposits located on Site.

For contrasting reasons, S-7 and S-13 were eliminated as the recommended remedial action. Implementation of these alternatives would produce significant short term adverse impacts to the surrounding area. In order for these alternatives to be completely effective, all the waste deposits would need to be excavated and redeposited into a secure facility. These alternatives were evaluated in terms of excavating and removing wastes from undeveloped portions of the property. Areas containing buildings, parking lots or roadways were not included as part of these alternatives. The physical problems and logistics associated with waste removal from under these structures is costly and impractical. Assuming that these deposits are allowed to remain in place, the effectiveness and driving force behind these alternatives is substantially reduced.

In addition to the logistical and implementation problems noted above, there are several short form adverse impacts associated with implementation of these alternatives. The RI determined that approximately fifteen percent of the sludge deposits are contained within the saturated zone. In addition, local surface waters are found in contact with the waste deposits at several locations. Excavation of the deposits will tend to suspend a portion of the waste material in the ground and surface waters. While engineering techniques can be implemented to minimize these potential impacts, the sheer volume of wastes to be excavated in order to successfully implement these alternatives makes the potential for a short term release very high.

Further, a significant amount of the material requiring removal as part of these alternatives are the animal glue manufacturing deposits. Past experience with the primary developer (Mark

Phillip Trust) indicates that disturbance of these deposits will cause a substantial release of odors. Release of these odors will pose a significant adverse impact to the public welfare surrounding the Site. As a result of the adverse impact to the welfare and the strong public resistence, the removal or rearrangement of the hide deposits is not feasible.

Costs associated with S-7 and S-13 are substantially higher than the next most costly alternative, S-8, which involves the excavation and on-site consolidation of waste deposits, capping the consolidated area with a 20 mil thick synthetic membrane and backfilling the excavated areas with clean off-site fill. S-8 costs approximately $24 million. S-7 costs $80 million while S-13, the off-site disposal option, would cost $209 million. Because S-8 was determined to be protective of the public health, welfare and environment and met the remedial objectives established for the Site, it would be considered acceptable as a remedial action. While the S-7 and S-13 alternatives are found to exceed the same criteria as S-8, the added costs would not produce a substantially better degree of protection than S-8.

The remaining alternatives basically can be classified as either in-situ containment or on-site consolidation and containment. The in-situ containment group can be further divided into permeable and impermeable covers.

Each alternative evaluated was found to meet or exceed the remedial response criteria for the wastes at this Site. Variations between alternatives evaluated in each subgroup were dependent on response level (action levels) and degree of reliability. The lower the response level and greater the degree of protection and reliability, the greater the costs. Briefly summarized below is a comparison of the remaining alternatives by subgroup.

Permeable Covers

This group includes alternatives S-4, S-6, S-11 and S-12. Costs ranged from $4.25 million for S-12 to $9.45 million for S-4. Each alternative in this subgroup was found to meet the remedial response criteria of minimizing or eliminating the direct contact potential. Each alternative was also found to meet applicable or relevant and appropriate Federal requirements. However, there was found to be a wide discrepancy in the degree of reliability provided by the alternatives in this group.

The lowest cost alternative in this group, S-12, involved remedial actions on areas found to be above the action levels established by the EA in the Feasibility Study. This alternative was rejected because it was determined to be only marginally protective of the public health, welfare and environment. While a six-inch topsoil cover would minimize the potential for direct contact, it is too thin of a layer to provide any degree of reliability. As discussed previously, the phenomenon

of the freeze-thaw cycle plays an important role in the determination of the adequacy of the cover. Any material contained within the frost zone is susceptible to being forced to the surface by the freeze-thaw cycle. Given the substantial reworking of the Site, high groundwater table and the heterogeneous nature of the waste deposits, the potential for this cover to fail from the freeze-thaw effect is a distinct possibility. Roots of weeds, bushes and trees may penetrate through the cover to the waste and expose it. In addition, erosion and unauthorized site activities, such as all-terrain vehicles or motorcycles, will quickly penetrate the effectiveness of this cover. These weaknesses in the reliability of this alternative could be minimized by an aggressive operation and maintenance program as well as increased frequency of monitoring, but given that this remedial action must last indefinitely, this aggressive approach could prove unreliable.

Alternative S-6 is very similar to S-12 except the area requiring remedial action is increased as the result of a lower response level (100 ppm versus 300 ppm As, 600 ppm Pb, 1000 ppm Cr). This lower action level is a somewhat arbitrary level selected by the responsible party. Stauffer Chemical Company selected 100 ppm based on a literature review of ambient concentrations of metals found in soils, a reasonable detection level given the proposed analytical equipment and as a result of establishing a correlation between an analytical number and a visual observation in the field. Stauffer demonstrated that for the Site there was a good correlation between visual observations of potential waste deposits and values of metals above 100 ppm. This correlation is potentially very important because visual detection of areas requiring remedial action with occasional spot checking using analytical methods is much quicker and less expensive than determination of the limits of remedial actions solely through the use of analytical equipment. As a result, the FS evaluates most of the alternatives based on this lower number. Alternatives S-12 and S-11 are the exception in that they use numbers obtained from the EA.

The use of Alternative S-6 was rejected for the same reasons discussed in the evaluation of Alternative S-12.

Alternative S-11 attempts to overcome the deficiencies found in S-6 and S-12 by increasing the thickness of the cover material to thirty inches. Under this alternative the Site would receive a site preparation similar to previous alternatives. Placement of the cover material would commence with eighteen inches of permeable bank run gravel. An additional six inches of fine sieved sand is placed on top of the eighteen inches, followed by a six-inch topsoil cover upon which is established a vegetative cover.

Implementation of this cover will place the waste deposits below the mean frost level for this part of the region. The application of this type of cover has been deemed appropriate

for asbestos landfills in Southern New Hampshire. The alternative is found to be protective of the public health, welfare and the environment by minimizing the direct contact potential. The cover is designed for a fifty to one hundred year design life. The cover will minimize the freeze-thaw cycle, eliminate root penetration by placement of the waste below the typical depth of root penetration (12 inches). In addition, erosion control of the cover can be maintained at regular intervals without the potential for accidental exposure.

Alternative S-11 is approximately $ 2.2 million more expensive than S-12. The majority of this additional increase in cost is directly related to the additional fill material required. The greater degree of reliability and protection resulting from S-11 more than offsets the increased costs.

Alternative S-4 is similar to S-11, except that it uses the lower action levels. Implementation of alternatve S-4 will provide a slightly greater degree of protection than S-11, except the alternative will cost an additional $ 2.9 million without providing a substantially greater degree of protection.

Impermeable Covers

Alternatives S-5, S-3, and S-2 are alternatives which provide a degree of impermeability. Each of these alternatives exceed the response objectives established for the Site. In addition to eliminating the direct contact potential, these alternatives prevent precipitation from leaching materials from the deposits and into the environment. The need for an impermeable barrier is not required for this Site. As noted in previous sections, the RI determined that waste deposits containing metals were not significantly impacting the ground or surface waters. A series of EP Toxicity testing further supported this conclusion. As a result, the installation of an impermeable barrier while further minimizing any leaching potential is unwarranted.

The FS evaluated three alternatives which provide a greater degree of impermeability. Of these three, two use a natural material, a bentonite soil mixture, and the remaining alternative uses a synthetic membrane to achieve its objective. In spite of the increased costs, the increase in environmental and public health protection is minimal. There are several reasons for this, each common to the three alternatives. The primary purpose of an impermeable barrier is to eliminate infiltration through a waste deposit. At this particular site a third of the area contains structures (buildings, parking lots and roadways) around which it would be impractical to establish and maintain a seal. Therefore, implementation of these alternatives would be jeopardized by the many gaps in the barrier. The effectiveness of an impermeable cover is based on the assumption that the wastes covered would remain above the saturated zone and as a result continued leaching would be eliminated. Site conditions are such that

approximately fifteen percent of the deposits are contained in the saturated zone.

Alternative S-5 uses a 20 mil thick PVC synthetic membrane to maintain impermeability. This membrane is bedded between two six inch thick zones of sand. Twelve inches of common borrow material would be placed over the sand followed by a six-inch topsoil cover with vegetation established to control erosion. This alternative was found to be protective of the public health, welfare and environment. The alternative was rejected based on increased cost without a substantial increase in protection or reliability. In addition, the use of a 20 mil thick liner raises concerns about implementability and long term usefulness. Current Agency guidance would require a thicker membrane to resist construction hazards and increase its resistance to failure.

Alternative S-3 uses a six-inch thick layer of a bentonite soil mixture to maintain an impermeable cover. The impermeability would be protected by the placement of an additional 24 inches of cover materials. While this alternative was rejected for the same reasons as S-5, the use of only six inches of a bentonite soil mixture raises some concerns about the ability of the alternative to effectively meet its goals. The use of a bentonite soil mixture, mixed on-site, raises issues relative to the ability of the mixture to maintain its stated permeability. Changes in mixtures, moisture content, raw materials or site conditions can produce areas where there may be lenses of less impermeable material than required. This potential is minimized by increasing the thickness of the impermeable layer. Increasing the thickness of the layer also compensates for variations in application thickness and cracking resulting from shrinking and swelling of the clay as the moisture content changes.

Alternative S-2 attempts to minimize the problem associated with S-3, however costs increased from $13.6 million for S-3 to $24.9 million for S-2. This alternative was rejected because the $24.9 million cost when compared to the $6.5 million cost of an alternative deemed to meet the remedial objectives is unwarranted. Implementation of this alternative would have required some modification (with an associated cost increase) as part of the Remedial Design. The modification would be the addition of fill material between the six inch topsoil cover and the twenty-four inch clay layer. This additional soil would be required to protect the impermeable layer from the effects of evapotranspiration and penetration by the root structure.

Consolidation Actions

The two remaining alternatives, S-9 and S-8, involve the use of on-site consolidation with subsequent covering of the consolidated deposit. The alternatives are the same except that Alternative

S-9 does not require the excavated areas to be backfilled with clean material, while S-8 does.

In each alternative the elimination of the potential for direct contact is accompanied by a reduction in the physical area requiring remedial action. Under these alternatives, waste deposits are excavated from various portions of the Site and used to recontour and consolidate deposits onto a fifteen acre parcel already containing waste deposits. These alternatives have the advantage of minimizing the area requiring deed restriction, operation and maintenance and monitoring. This would "free up" land for future development. Consolidation options are attractive alternatives when there is a substantial reduction in area requiring additional controls. Site conditions, however, do not lend themselves to this attractive feature. As noted previously, the Site contains a number of structures, which indicated that waste material should remain in-situ. As a result, while reducing the areas which required ongoing O&M and monitoring, this alternative would leave behind a number of discrete satellite deposits under the structures which would still require institutional controls and monitoring. This fact destroys the primary feature of the consolidation option. In addition, once the material is excavated, it is typically deposited into some sort of engineered structure, such as a RCRA landfill. By placing the material into a RCRA landfill the waste can be carefully controlled to eliminate the potential for future release. Under this alternative the waste does not receive full benefits of the consolidation option, such as a bottom liner or leachate collection system.

Site conditions and the level of protection required at the Site does not warrant the increased costs for only a small increase in protection associated with these alternatives. The primary advantage gained from this group of alternatives is minimizing the area requiring deed restrictions and freeing up land for additional development. In addition to these concerns, Alternative S-9 does not require backfilling of the excavated areas. While this substantially reduces the costs ($10.25 million versus $19.21 million), it allows the Site to remain in an unacceptable condition. Area requiring excavation may reach depths in excess of fifteen feet below grade. These areas would quickly fill up with precipitation and groundwater, thereby creating an attractive nuisance.

Operation and Maintenance costs for the soils alternatives are found on Tables 42 and 43, and the capital, operation and maintenance and present worth costs are summarized on Table 52.

RECOMMENDED REMEDIAL ACTION FOR AIR

Listed below are the six alternatives evaluated in detail for remediating the problems posed by the East Hide Pile. Present worth costs for each alternative also provided.

	Alternative	Present Worth Costs
A-1	No Action (Monitoring Only)	$171,000
A-2	Dewater the wetlands, stabilize slope, cover with 20 mil synthetic membrane, vegetate, deed restrictions	$2,030,000
A-3	Dewater the wetlands, stabilize slope, install gas collection/ blower system, cover with 20 mil synthetic membrane, vegetate, activated carbon treatment, deed restrictions	$2,799,300
A-4	Dewater the wetlands, stabilize slope, install gas collection/ blower system, cover with 20 mil synthetic membrane, vegetate, thermal oxidation treatment, deed restrictions	$3,109,000
A-5	Excavate and remove East Hide Pile, dispose of in on-site RCRA landfill with gas treatment systems as in A-3 or A-4	$15,510,000
A-6	Excavate and remove East Hide Pile, dispose of at off-site RCRA landfill	$35,860,000

A modified version of alternative A-3 or A-4 will be selected as the most cost effective remedial action that mitigates the threats to, and provides adequate protection of public health and welfare and the environment. These two alternatives offer equivalent degrees of protection and reliability. The final solution of an alternative that will mitigate the odor impacts will be made by the Regional Administrator in a supplemental decision document. This decision will consider results of a monitoring study conducted subsequent to installation of the impermeable barrier and gas collection system. Final selection of gas treatment offered by alternatives A-3 or A-4 will be made after evaluation of gas emission rates from the pile once the impermeable barrier is in place and the pile has had time to stabilize. The FS indicated that the piles would reach equilibrium in approximately seven weeks. The Agency will assess degree of pile equilibrium after monitoring pile gas generation. The Agency will design and implement a monitoring plan capable of measuring the rate of pile stabilization by observing gas flow rate and gas concentration. The monitoring shall continue until the Agency can adequately determine which gas treatment alternative will be the most efficient and cost effective and provide a long term odor emission remedy. During the monitoring program a temporary treatment system shall be

installed to minimize or eliminate the potential release of obnoxious odors. Prior to a final decision the Agency shall make available the data and rationale for the gas treatment option selection and an explanation supporting the Agency's decision.

A major engineering concern during design and implementation of alternative A-2 or A-3 is preservation of the environmental integrity of a shallow pond and associated wetlands. The wetlands are approximately four acres in area and are located between the East and West Hide Piles. Either alternative as illustrated in the FS requires that these wetlands and pond be filled and a drainage system installed to dewater the pond, wetlands and the local groundwater. The destroyed pond would be filled and provide more area to establish three to one side slopes on the East and West Piles. A primary reason for draining the pond and wetland is to lower the local groundwater table to lower the groundwater mound within the hide piles. The FS concluded that fluctuation of the groundwater mound complicated gas treatment process operation. The FS also concluded that the greatest reduction of the groundwater mound would be accomplished by dewatering and lowering of the groundwater table. It concluded that installation of a synthetic membrane to cap the pile would not effectively result in a significant mound reduction and destruction of the pond and wetlands needed to be part of successful implementation of the recommended remedial alternative.

The Agency disagrees with the conclusion for the need to dewater the pond and its associated wetlands. Executive Order 11990 concerning wetlands prohibits the elimination of wetlands except in specific and limited circumstances. The Agency, through this Executive Order and § 404 of the Clean Water Act recognizes the value and importance of wetlands and the need to protect them from destruction. It is the Agency opinion that the circumstances and data concerning the wetlands and hide piles do not support the need for wetlands elimination. The Agency agrees that the approach outlined in alternatives A-2, and A-4 would ensure maximum dewatering of the piles. In addition, the Agency agrees that the proposed dewatering would enhance remedial action reliability as well. However, the Agency believes that other techniques employing common engineering practices that will provide adequate protection, meet the odor control needs, and provide protection of welfare will not substantially impact the wetlands. The Agency will modify the FS recommended alternatives during the Remedial Design process to balance the need to eliminate odors and to protect wetlands. As part of the supplemental FS, Stauffer submitted a Wetlands Assessment in which an alternative to minimize the impact on the wetlands using sheet piling was evaluated. The use of sheet piling to stabilize the side slopes while minimizing the impacts to the wetlands was deemed to be an appropriate method for addressing the requirements of §404(b)(1). However, Stauffer rejected use of this alternative based on their determination

that dewatering the piles by eliminating the groundwater mound was the most important criterion. As noted previously, the Agency rejected Stauffer's conclusion and as a result believes that the use of sheet piling is an effective technique for implementing more aggressive slope stablization techniques in order to protect the wetlands. A moderate increase in the sizing of the treatment system will accomodate any additional gas production resulting from the increased moisture contained within the pile. Figures 15 and 16 show the details of the sheet piling technique.

In addition, as part of the remedial design, the Agency will design and implement a monitoring plan capable of accurately measuring the rate of stabilization, the gas flow rate, and the gas concentration. Action levels and a contingency plan will be established in the design phase. If concentrations approach the action levels, the contingency plan will be implemented to protect the public health. The monitoring shall continue until such time as the Agency can adequately predict which alternative will provide the most efficient, cost effective long term remedy to the emission of odors. In the interim, a temporary treatment system (such as activated carbon) shall be installed to minimize or eliminate the potential release of obnoxious odors during the monitoring program.

Alternative A-1, the no action alternative was rejected because it did not meet the remedial objectives to eliminate odor or to conform with the applicable or relevant and appropriate public health and environmental requirements. No action at the Pile would maintain current Site conditions with wastes at or near the surface of the Pile and wastes brought to the surface by the continued sloughing and erosion of the Pile. These conditions would continue to pose a direct contact hazard to the public. The unabated emission of odors from the Site would continue to threaten the public welfare. Allowing continued release of odors would violate relevant and appropriate state standards for the control of air pollution. The continued sloughing and eroding of contaminated material into the wetland and surface water would violate the applicable or relevant and appropriate requirements of the CWA and Executive Order 11990. The FS did not present and the Agency has not been able to identify a remedial alternative addressing the Hide Pile problem that does not adversely impact the wetland because Hide Pile wastes were deposited directly in the wetland. In the absence of any alternative that can avoid wetland impacts, an alternative that minimizes these adverse impacts would conform with the Executive Order 11990.

Alternative A-2 recommended stabilization of pile side slopes and trapping the odorous gases under an impermeable membrane cap. This alternative was rejected because it did not adequately protect public welfare or mitigate threats to the environment. Slope stabilization and the impermeable cover will substantially reduce the pile moisture content and reduce microbial action

that generates gases; however, gas production would continue after installation of an impermeable cover and would remain a significant concern. Numerous investigations of municipal landfills have provided information concerning gas production rates and possible uses for the gas generated at municipal landfills. Methane gas production at several landfills is sufficient to justify extraction for commercial uses. Gas production, negative impacts and the associated odors are not adequately addressed by alternative A-2. Methane gas (a major component of the gases) can be generated in significant quantities in the pile to result in decreased cap integrity due to physical ballooning or cover distortion and gas may reach explosive concentrations.

Alternative A-5, proposed excavation of the pile and disposal in an on-site RCRA landfill. This alternative was rejected because it cost $15.5 million and its impacts on the environment and the public welfare are unacceptable. Excavation of the pile will necessarily release intense, obnoxious odors into the environment, adversely impacting the public welfare. Neither the Agency nor the DEQE knows of any method which will reliably control or eliminate the odors generated by excavation. The odors are so intense, the problem so long-standing and the community opposition to the odors so high that the Agency would face strong community opposition and possibly litigation, if this alternative were chosen.

Implementation of A-5 would adversely impact wetlands, surface water quality and possibly groundwater quality. Releases of waste to surface and groundwater as well as destruction of the wetlands by access roads built and sheet piling installed in the wetland would occur during implementation of this alternative. Further, worker safety would be a major concern as a result of the attendant releases of hydrogen sulfide and methane gas, presenting the possibility of poisoning or asphyxiation.

The Agency finds that alternative A-5 is not protective of the public welfare nor in conformance with relevant and appropriate regulations. Further, the Agency has determined that this remedy is not more cost effective because it is five times more costly than the recommended remedial actions.

Alternative A-6 proposed excavation of the Hide Pile and its disposal at an off-site RCRA facility. This alternative was rejected because it costs $35.8 million and its adverse impacts to the environment and public welfare are unacceptable. This alternative would include negative environmental impacts similar to those discussed for alternative A-5 and the impacted public would expand to include those people along the waste transport route and near the disposal facility as well as those near the Site. The cost of this alternative is more than double that of alternative A-5 and an order of magnitude greater than that of the recommended remedial action.

RECOMMENDED REMEDIAL ACTION FOR GROUNDWATER

Listed below are the four alternatives evaluated for remediation of the groundwater contamination.

	Alternative	Present Worth Costs
GW-1	No Action Alternative Quarterly Monitoring Only	$850,000
GW-2	Groundwater interception/recovery of on-site "hot spot" areas, treatment with subsurface discharge	$2,960,000
GW-3	Groundwater interception/recovery at Site boundary, treatment with surface water discharge	$4,220,000
GW-4	Groundwater interception/recovery at leading edge of plume, treatment with surface water discharge	$11,150,000

Of the four alternatives, only GW-4 meets the applicable or relevant and appropriate Federal public health and environmental requirements. By capturing all the contaminants found in the groundwater from the Site, this alternative would theoretically restore the aquifer to a pristine condition. Selection of alternative GW-3, capture and treatment at the Site boundary might also be protective of the public health and welfare and the environment as well as potentially complying with the applicable or relevant and appropriate requirements. Alternative GW-3 would capture and treat approximately ninety percent of the plume, allowing the remaining ten percent to further migrate off-site and downgradient. The remaining concentrations might meet RCRA standards by establishing an ACL for the groundwater at the Site boundary.

Pursuant to §300.68(i)(5)(i) of the NCP, the selected remedy for groundwater is alternative GW-2. This remedy is an interim remedy until a determination as to the most effective solution to an area-wide groundwater contamination problem can be made. As briefly summarized in the Current Site Status section, the Agency has knowledge of a number of actual and potential sources adversely impacting the groundwater surrounding the Site. Upgradient of the Site are several active industial operations, each with an ongoing groundwater problem. Abutting the Site to the west and northwest are a large municipal landfill, two barrel reclamation operations, two chemical manufacturers and two large trunk sewer lines with a long history of surcharging. In addition to these actual and potential groundwater impacts, southwest of the Site is a company with a fuel oil problem impacting the groundwater.

Each of these problems is contributing to the general degradation of the groundwater quality in this portion of the aquifer. Farther downgradient, the portion of the aquifer serving Wells G and H has a separate groundwater contamination problem. Investigations into the potential impacts on groundwater from the above noted sources are ongoing.

Because the scope, direction and pace of each of these investigations if different, there is a potential that decisions regarding groundwater remediation may be inconsistent with the overall goals of the Ground Water Protection Strategy. Current CERCLA guidance recognizes that specific decisions about groundwater remedial actions resulting from a CERCLA site should be made in conjunction with the resolution of the larger area-wide groundwater problem. As a result, CERCLA guidance permits the selection of an interim remedy until a more comprehensive investigation of the area-wide groundwater problem can be completed. This investigation is referred to as a Multiple-Source Ground Water Response Plan (MSGWRP).

The Agency believes that the implemention of a MSGWRP is required prior to a final decision as to the extent of the groundwater remediation at the Site. The Agency further believes that the MSGWRP is the most efficient response to the remediation of the groundwater problems associated with the Site as well as the larger problems within the aquifer.

Based on the preceding determination the Agency believes that implementation of alternative GW-2 is the most cost effective response to minimize the impacts to the public health, welfare and environment while resolving the larger regional problem. Under this alternative the FS estimated that eighty percent of the benzene and slightly less of toluene would be captured within a six to nine month period through careful placement of recovery well systems. Three of the four alternatives seek to control and minimize the impact on groundwater resulting from the benzene plume. Alternative GW-1, the no action alternative, does nothing to minimize the potential impact on the downgradient aquifer supplying Wells G & H, it only seeks to monitor the plume's downgradient migration. Depending on the length of time necessary to design, implement and reach a decision on the multiple source groundwater response plan this alternative may be an appropriate response to the on-site groundwater problem. The implementation of GW-2 appears to be the most appropriate interim remedial action under the present Site conditions. Alternative GW-2 seeks to capture and treat approximately 80% of the contaminant of concern (benzene) within a relatively short time frame (less than 6 months). Using GW-2 as the interim remedy take positive steps in a cost effective manner to minimize the impacts to the off site public health and environment while permitting the MSGWRP to create a long term response plan for remediation of the aquifer. The ease of implementation, its short operation period, and its containment of the majority of the plume make it ideal as an

interim groundwater remedy.

While GW-3 and GW-4 provide a greater degree of protection for the public health and welfare and the environment than the previous two alternatives, they are not appropriate as interim remedies. The primary purpose of an interim remedy is to undertake an action which will provide the maximum degree of protection at the least cost while additional studies are undertaken to ensure that any long term remedial action at a site is consistent with the larger environmental goals associated with the aquifer. In the case of GW-3 and GW-4 the substantial period of operation (10+ years) and increased capital and operation and maintenance costs make them unsuitable as interim remedies.

VIII. OPERATION AND MAINTENANCE (O&M)

A key component of any remedial action is the development and implementation of an effective operation and maintenance (O&M) program. This program will ensure that the effectiveness of the remedial actions is maintained through periodic monitoring, inspection and preventative maintenance. A major part of any effective O&M program is a sampling and analysis effort. The sampling plan is intended to provide the basis for determining the effectiveness of the remedial action and to serve as an early warning system should the remedial action begin to fail. In addition, the monitoring program helps to track the rate of remediation (when applicable) and assists in the decision to modify the operating parameters of a remedial action to provide for a more efficient clean-up or better protection.

For each remedial action selected, there are proposed O&M and monitoring costs associated with it. Costs for the soils alternative S-11 are on Table 42, those for air are on Table 49, 50 and 51, while costs for groundwater are located on Table 22. Monitoring costs associated with the overall Site are summarized on Table 43. Summarized briefly below is a description of the O&M tasks associated with each recommended remedial alternative.

SOILS

The O&M tasks associated with the soils alternative are simple and straightforward to implement. Basically, the costs include an annual inspection to visually determine that the cap's integrity is intact. Any area requiring repair would be covered with additional fill material in order to eliminate the potential for direct contact. This annual inspection would typically be performed in the spring in order to determine the effects on the cap from from the freeze-thaw cycle. This detailed inspection would record in writing the physical integrity and condition of the cap. Records of these inspections would be retained in order to evaluate the long-term performance of the remedial actions and to identify areas potentially requiring future preventative maintenance. Less intensive periodic inspections would be conducted as needed, such as after a particularly severe rainfall

when the erosion potential is high.

Costs associated with maintenance include a twice yearly mowing of the vegetative cover, patching and repairing erosion gullies and covering areas subjected to the effects of the freeze-thaw cycle. Periodic bush and tree removal, as well as re-seeding portions of the vegetative cover will be performed as necessary.

Responsibility for periodic O&M on developed areas would lie with the existing property owner. Ensuring compliance with the terms of the O&M will be the responsibility of the controlling regulatory agency.

The actual nature and scope of the O&M plan will be developed and approved as part of the Remedial Design process; however, the general outline of the program will comply with requirements set forth in RCRA Part 264 Subpart G - Closure and Post Closure and Subpart N - Landfills.

AIR

Operations and maintenance for the recommended remedial action are broken into three parts: maintenance of the impermeable cover, O&M of the gas collection system, and the O&M of the gas treatment system.

For the first part, O&M will include periodic inspections of the impermeable cover system. Specifically, actions will include detection of subsidence and slope stability poblems. As proposed, the western toe of the slope will be secured using sheet pilings driven into the bottom of the pond. The area behind the pilings will be backfilled with clean material which serves as a base to anchor the synthetic membrane. Periodic maintenance of the sheet pilings will be required to ensure that the toe of the slope resists the effects of sheer failure resulting from the relatively steep side slopes. Similar to periodic maintenance requirements under the soils alternative, mowing the vegetative cover as well as repairing seeded areas are included in the cost of the O&M plan.

The second part of the O&M under this alternative is the periodic maintenance associated with the gas collection system. Costs and actual maintenance on the below cap collection system is projected to be minimal; however, there are electrical and maintenance expenses associated with the blower system. The blower system is designed to actively withdraw gases from the pile; this requires a positive induction fan. These fans are very common, are widely used and are easy to maintain and operate. Projected maintenance would include periodic inspection, lubrication and adjustment.

The final phase of the O&M requirements under this alternative is the operation and maintenance of the gas treatment system itself. Specific requirements are dependent upon the selection of either A-3 or A-4; however, the general type of requirements are found

on Table 50 for A-3 and Table 51 for A-4. It should be noted that either treatment system will require a part-time treatment plant operator. Costs associated with the treatment plant operator are illustrated with the groundwater alternatives.

GROUNDWATER

The operation and maintenance (O&M) requirements for the treatment of groundwater include the periodic maintenance of the interceptor well system. Costs primarily associated with this portion of the system are the electrical utility costs for operating the pumps. Periodic maintenance for the pumps may include occasional rebuilding or replacement of the pumps themselves and maintaining the piping system and flow meters.

A part time plant operator will be required to ensure that the treatment system is operating properly and in compliance with established operating parameters. Tasks include periodic replenishment of chemicals used in the odor control process, adjustment of flow rates to maximize the efficiency of the air stripping system and periodic inspection and maintenance of the subsurface discharge system. Other costs associated with the treatment system include chemical and electrical costs as well as plant operator salary.

MONITORING

A comprehensive sampling and analysis program will be developed and implemented as part of the Remedial Design process. The primary purpose of this program is to monitor the overall effectiveness of the implemented remedial actions. Economy of scale can be attained by developing a single program maximizing the number and locations of monitoring points to address more than one media. This approach provides the added advantage of integrating the three proposed remedial actions by looking at sampling results in light of the entire site. The program will include sampling and analysis of ground and surface waters, soils and air. Also included will be sampling and analysis of various points within the groundwater and air treatment systems to assist the Agency in maximizing the efficiencies of the systems.

Table 43 illustrates the level of effort and costs associated with the sampling plan. The table indicates a semi-annual frequency rate; however, the Agency believes that quarterly monitoring for the environmental parameters and more frequent monintoring for the process analysis is required. The actual development and implementation of the monitoring plan will be consistent with requirements set forth in Part 264 of RCRA.

IX. SCHEDULE

Listed below are key milestones and dates for successful implementation of this project.

° Approve remedial action (sign ROD)	September 30, 1986
° Complete Enforcement Negotiations	January 1, 1987
° Send Interagency Agreement (IAG) to Army Corps of Engineers for Design	January 15, 1987
° Start Remedial Design	February 15, 1987
° Start pre-design field studies	March 1, 1987
° Complete Remedial Design	November 15, 1987
° Amend IAG for construction	November 15, 1987
° Start construction	December 1, 1987
° Complete construction	October 1, 1989

This schedule is dependent on the availability and obligation of funds to implement the project design and construction. The time lag before obligation of final remedial action funds will protract the schedule for implementation by an equal length of time.

X. FUTURE ACTIONS

This Record of Decision encompasses all remedial actions necessary to protect the public health, welfare and environment. However, a number of additional actions necessary to ensure the successful implementation of the remedies will be undertaken.

Additional field investigations as part of the Remedial Design will need to be undertaken to resolve the following issues.

- ° Additional soil borings and test pits to more accurately characterize the extent and distribution of waste deposits within the developed areas requiring remedial actions and areas receiving institutional controls only.
- ° Additional soil borings and test pits south of the original Site area (as defined by the Consent Order). Specifically the Right of Way Number 9 owned by Boston Edison will be the focus of this additional effort. Data collected will be used to calculate quantities of fill material necessary to implement a remedial action.
- ° Additional soil borings and monitoring wells in the vicinity of the East Hide Pile. This additional effort will be used

to identify the exact requirements necessary to establish a firm base at the toe of the East Hide Pile to minimize the effects of the slope failure. This additional information is critical to ensuring that the impact to the wetlands is kept to an absolute minimum. The installation of the monitoring network will develop a better base of monitoring data on the impacts resulting from the East Hide Pile.

- Additional groundwater sampling and monitoring to more accurately characterize the "hot spot" areas.

This additional testing will be used in pilot studies on the treatability of the groundwater as well as assisting in the development of operating parameters such as pumping rates, location of interceptor wells and period of performance.

Because the Agency has selected an interim groundwater remedy prior to resolution of the area-wide problem it is important that the development and implementation of the Multiple Source Ground Water Response Plan (MSGWRP) begin as quickly as time and funding will allow. The actual form of the MSGWRP is not yet fully defined. The Agency believes that the formalization of the plan will come as a result of ongoing discussions with the DEOE and the City of Woburn. This formalization perod is expected to take approximately six months; however, implementation of the actual plan is dependent on the reauthorization of CERCLA.

A subsequent decision by the Regional Administrator on the long term groundwater remedial action will be required. It is envisioned that this decision will be in the form of a Record of Decision and will be based in part on the conclusions from the MSGWRP.

As noted previously, a subsequent decision by the Regional Administrator on the air treatment system will be required. This document will briefly summarize the results of the monitoring program conducted on the venting system from the East Hide Pile and recommend either A-3 or A-4 as the more cost-effective alternative. The document will not be a ROD document, but a memo documenting the selection of one of two equally acceptable alternatives based on field data.

The Agency selected a soils remedial action which requires the placement of thirty inches of clean fill materials to eliminate the potential for direct contact. As part of the public comment period, Monsanto Chemical Company, a responsible party submitted a lengthy document critiquing the RI/FS. While Monsanto generally agreed with the overall approach and extent of the proposed remedy, it felt that thirty inches of cover material was unnecessary and excessive. Monsanto in its public comments indicated that twelve inches of cover material was more appropriate and has subsequently increased its estimated thickness to fifteen inches. The Agency selected the thirty inch cover

options based on experience gained by the covering of asbestos landfills to eliminate the potential for direct contact in Southern New Hampshire.

The Agency recognizes that other engineering solutions to eliminating both the short and long term problems exist for application at the Site. These other engineering solutions may in fact be equivalent to the selected remedial alternative pending additional investigation and evaluation. The additional documentation and rationale for the fifteen inch engineered cover proposed by Monsanto was not available prior to close of the public comment period. As a result, it is premature for the Agency to comment on the efficacy of Monsanto's proposal. If subsequent review and evaluation of the Monsanto proposal determines that it is equally protective of the public health, welfare and environment, meets the criteria established in the ROD and is more advantageous to implement in terms of costs, implementability and reliability the Agency would request subsequent approval by the Regional Administrator prior to completion of the Remedial Design process.

Future actions also include monitoring the effectiveness of the cap, groundwater and air treatment systems as well as assuring future effectiveness of these actions through proper operation and maintenance. Monitoring for cap effectiveness is required under 40 C.F.R. Part 264 Subparts F and G and Subpart N §264.310(b).